UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE RO

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REPLY TO: 3420

DATE: MAR 08 1988

SUBJECT: Biological Evaluation of Two Timber Stands on Georgetown RD (Report No. 88-4)

TO: Forest Supervisor, Eldorado National Forest

On March 1, 1988, Gregg DeNitto and Susan Frankel, Forest Pathologists, and David Schultz, Entomologist, of the Forest Pest Management Program evaluated two stands for pest conditions on the Georgetown Ranger District. The two stands are being considered as part of two separate, planned timber sales. This evaluation was done at the request of Bill Cox, Assistant Silviculturist on the District. The District is considering including these stands in proposed timber sales. Also, Bill is planning on using one stand for preparing a silvicultural prescription for certification.

STAND 1

The first stand is an 11 acre unit adjacent to Unit 5 of the planned Missouri Canyon Sale (T. 13 N, R. 11 E, section 14). This unit is bounded on two sides by private land. The stand is an even-aged (approximately 80 years old), mixed conifer stand growing on a Dunning site 1A. Species composition is 60% Douglas-fir, 30% ponderosa pine, and 10% sugar pine/incense-cedar. Basal area averages over 400 sq. ft./ac with an average dbh slightly above 12 inches. Mortality has been occurring in the stand, both as scattered individuals or groups of 2-3 trees and in one large opening (about 1 acre). There is no history or evidence of cutting in the stand other than some timber stand improvement work done in the last 5-10 years. The primary management concern in the stand is the large amount of fuels that are on the ground.

The mortality mainly involves the ponderosa pine. It was suspected that root disease, either black stain or annosus, might be involved in the large opening. Neither disease was found and mortality characteristics did not support the suspicion. Evidence of attacks by western pine beetle (Dendroctonus brevicomis) and red turpentine beetle (D. valens) were observed.

This stand consists of tall, slender trees with low live crown ratios because of their development under very heavy competition. Some of the trees have suffered top breakage in the past due to heavy snow, wind, or a combination of both. The broken-out tops not only contributed to the heavy fuel loads, but some also provided breeding habitat for pine engravers, Ips spp. When the pine engravers emerge, they may kill the tops of nearby pines. The top-killed and broken-topped pines are quite susceptible to attack by western pine beetle.

Because these beetles release an aggregating pheromone during the initial attack, a large number of beetles may be attracted toward the attack site. The high density of host trees in the stand can result in small groups of trees being killed. While the number of trees involved in top breakage and subsequent mortality each year in the stand is fairly low, the cumulative effect is substantial. A more important effect, however, is that this frequent mortality has maintained a supply of western pine beetles on the site, ready to take advantage of any susceptible host trees.

The basic cause of the mortality is the lack of adequate soil moisture to support the number of trees on the site. The excessive stocking has significantly reduced the ability of many of the trees to successfully repel attacks by cambium-feeding insects. These insects introduce blue stain fungi which act in conjunction with the girdling effects of the insects to restrict water flow in the tree, resulting in mortality. The amount of mortality will fluctuate from year to year depending principally on the amount of precipitation received and the number of suitable hosts, mainly ponderosa pine, remaining in the stand.

The following three alternatives could be applied to this stand. This discussion focuses on how implementation would affect the future condition of the stand with respect to pest impacts.

1) NO ACTION. No management actions would be planned for this stand during the next 10 years. Mortality would continue and could be expected to increase to higher levels following any droughty years. Most of the insect-related mortality will be in the ponderosa pine. Some low vigor Douglas-fir may succumb to flatheaded fir borer (Melanophila drummondi) attack, but this insect is not as aggressive as the above mentioned pine bark beetles. Additional openings might be created in any concentrations of ponderosa pine. As the stand opens, residual Douglas-fir may suffer increased top-breakage from occasional heavy snows.

2) THINNING. A thinning would be planned to reduce the basal area to levels more appropriate to the site. The stand has been overstocked for so long that the trees have very small crowns and root systems. A single entry to reduce the stocking to these levels would drastically open the stand and, even if the trees responded favorably, it would be many years before the stand would fully utilize the site. One or more entries which remove a small percentage of the existing basal area have the greatest potential to increase growth and decrease mortality. Because of the existing tree size, the first entry would probably be a precommercial thinning directed at removing trees in the intermediate and suppressed crown classes, as well as other trees with small live crowns. Mortality would be reduced for two reasons. First, intertree competition for soil moisture would be reduced and residual trees should gain somewhat in vigor. This would reduce the success rate of bark beetle attacks. Second, many of the low vigor, highly susceptible trees will be removed in the thinning operation, thereby reducing the amount of habitat for the beetles. Opening the stand may have some deleterious effects, however. There would be reduced protection of the residual trees from snow breakage and sunscald. Douglas-firs would be the more susceptible species to both of these agents.

3) REGENERATION. The existing stand would be harvested and the site would be planted. Through the application of proper cultural practices, the site could be returned to a higher rate of growth and higher productivity.

STAND 2

The second stand examined is Unit 6 in the planned Hog sale (T. 12 N, R. 11 E, section 16). This approximately 25 acre stand is on a Dunning site 2 and is 70 years old. It is an even-aged stand comprised primarily of sugar pine (70%) and ponderosa pine (30%). Average stand basal area is 100 sq. ft./ac. with an average dbh of 13 inches. There was likely an overstory removal several decades ago. More recently, a manzanita brush layer was reduced through machine mastication (Hydro-ax).

Three diseases were observed in this stand. Sugar pine and ponderosa pine were infected by their respective dwarf mistletoe (Arceuthobium californicum and A. campylopodum) in at least part of the stand. Both dwarf mistletoes were concentrated in the northwest corner of the stand. Infection levels were higher in the ponderosa pine and the area infested also was greater than sugar pine. Partway down the east slope, two sugar pines, one seedling and one sapling, were infected by white pine blister rust (Cronartium ribicola). At present, the amount of infection is low, but it is uncertain how the fungus might react if significant changes in the microenvironment and host populations occurred.

Two reasonable alternatives exist for this stand, no action or regenerate. The effects of each of these on timber production with respect to pests are discussed.

1) NO ACTION. No management actions would be implemented in this stand. Occasional mortality can be expected, but not in excess of what might be considered average for such a stand. Probable candidates for this mortality are individuals of both pine species that have heavy dwarf mistletoe infection levels. Because of the even-aged and mixed species nature of the stand, the spread of either dwarf mistletoe species will be slow. It is estimated that outward annual average spread would be one foot or less. If infected trees begin to show an increase in height growth, the level of infection in individual trees may decrease. White pine blister rust should not be a concern in this stand. Natural sugar pine regeneration, which is presently limited, may be killed. Trees in the existing stand have outgrown the susceptible size classes and are not considered in danger.

2) REGENERATE. Because of the low stocking on a high site, a regeneration harvest might be considered. Two pest concerns exist for this particular site if it is regenerated. Because part of the adjacent stand is infected by both species of dwarf mistletoe, it could serve as a seed source for reintroduction of these parasites into the regenerated stand. Sugar pine dwarf mistletoe will not be of concern if sugar pine is not planted (see below). The western dwarf mistletoe in ponderosa pine would need to be addressed during sale planning and layout. A mistletoe-free buffer around the regenerated stand should be created within 10 years of planting, preferably at the time of the regeneration harvest. Because dwarf mistletoe is not present in many areas of the surrounding stands, much of the periphery of the stand does not need a buffer. Based on tree and dwarf mistletoe heights in the area, a 50 to 75 foot buffer should be sufficient to greatly reduce the probability of reentry of dwarf

BIOLOGY OF PEST ORGANISMS

WESTERN PINE BEETLE, (Dendroctonus brevicomis). The western pine beetle breeds in the main bole of living ponderosa and Coulter pine larger than about 4 inches dbh. Normally it breeds in trees weakened by drought, overstocking, root disease, dwarf mistletoe or fire.

Adult beetles emerge and attack trees continuously from spring through fall. Depending on the latitude and elevation, there can be from one to four generations per year. The generations are difficult to distinguish because the prolonged period of initial attack and re-emergence of parent females to establish additional broods causes considerable overlapping of the generations.

Initial attacks are made about mid-bole and subsequent attacks fill in above and below. Pheromones released during a successful attack attract other western pine beetles. Attacking beetles may spill over onto nearby apparently healthy trees and overwhelm them by sheer numbers. Pitch tubes and red boring dust are indications of successful attacks.

Adults bore a sinuous gallery pattern in the cambium and the female lays eggs in niches along the sides. The larvae feed in the inner bark for a short distance and then turn into the outer bark to complete development.

Bluestain fungi introduced during successful attacks probably contribute to the rapid mortality associated with bark beetle attacks.

DWARF MISTLETOES (Arceuthobium spp.). Dwarf mistletoes are parasitic, flowering plants that can only survive on living conifers in the Pinaceae. They obtain most of their nutrients and all of their water and minerals from their hosts.

Dwarf mistletoes spread by means of seed. In the fall the fruit ripen and fall from the aerial shoots. The seeds are forcibly discharged. The seed is covered with a sticky substance and adheres to whatever it contacts. When a seed lands in a host tree crown, it usually sticks to a needle or twig, where it remains throughout the winter. The following spring the seed germinates and penetrates the twig at the base of the needle. For the next 2-4 years, the parasite grows within the host tissues, developing a root-like system within the inner bark and outer sapwood, and causing the twig or branch to swell. Aerial shoots then develop and bear seed in another 2-4 years.

Dispersal of dwarf mistletoe seeds is limited to the distance the seeds travel after being discharged. From overstory to understory, this is usually 20 to 60 feet, but wind may carry them as far as 100 feet from the source. A rule of thumb is that the seeds can travel a horizontal distance equal to the height of the highest plant in an infected tree. There is some evidence that long distance spread of dwarf mistletoe is occassionaly vectored by birds and animals. Vertical spread within tree crowns of most dwarf mistletoes is limited to less than one foot per year because of foliage density.

Dwarf mistletoes are easy to identify because they are generally exposed to view within a tree's crown. Signs of infection include the yellow-green to orange

mistletoe into the stand. All trees do not need to be removed from this buffer, but only those that could reintroduce mistletoe seed into the new stand. These would most likely be larger trees with infections higher in the crowns. If non-hosts exist in the buffer area between infected trees and the regenerated stand, they may sufficiently intercept seed to reduce the need to remove the infected trees. Installing a buffer around this stand should be done by having trained personnel examine and mark indivdual trees using their professional judgement and the guidelines above.

The second pest concern in regenerating this site is white pine blister rust. It is recommended that no more than 10% of the planting mix be made up of sugar pine, unless blister rust resistant stock is available. Even though the present infection level of blister rust is low, a regeneration harvest would significantly alter the microenvironment and host populations, thereby possibly influencing the future infection level of the disease. At this time, we do not know what effect these alterations would have on this particular site, but observations in other areas suggest that considerable loss of sugar pine could be expected.

We appreciate the efforts of Bill Cox in organizing this functional assistance trip. We are available to provide pest management assistance in other areas at your request. If there are any questions about this evaluation, please contact Gregg DeNitto, David Schultz, or Susan Frankel at 415-556-6520.

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